DEPARTMENT OF DEFENSE

MANUFACTURING AND INDUSTRIAL BASE POLICY (MIBP)

Identifying and Mitigating Industrial Base Risk for the DoD: Results of a Pilot Study

Sector-by-Sector, Tier-by-Tier (S2T2) Fragility and Criticality Assessments

Sally Sleeper, Ph.D.[1]
John Starns, D.Sc. [2]
Eugene Warner, Ph.D.[1]

AFCEA Acquisition Research Symposium
May 14-15, 2014

[1]OUSD(AT&L), Manufacturing and Industrial Base Policy
[2] Northrop Grumman Technical Services

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
MAY 2014		**00-00-2014 to 00-00-2014**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Identifying and Mitigating Industrial Base Risk for the DoD: Results of a Pilot Study: Sector-by-Sector, Tier-by-Tier (S2T2) Fragility and Criticality Assessments	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Office of the Under Secretary of Defense for Acquisition, Technology OUSD(AT&L) ,Manufacturing and Industrial Base Policy,Washington,DC,20301**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

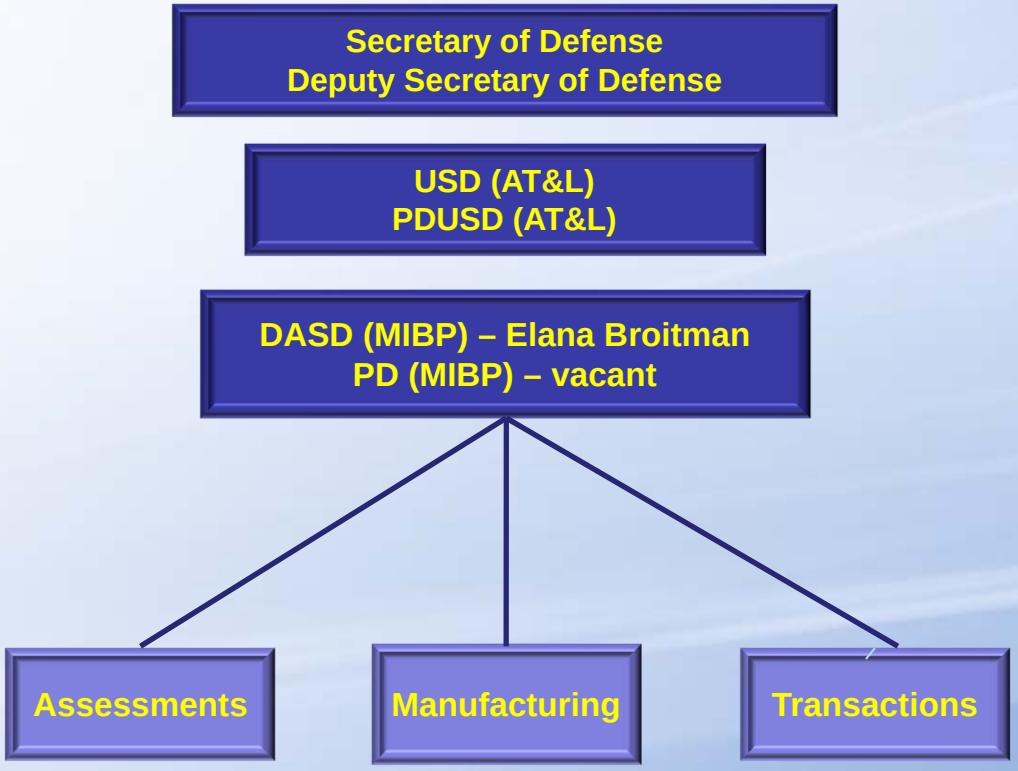
15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**23**	

Outline

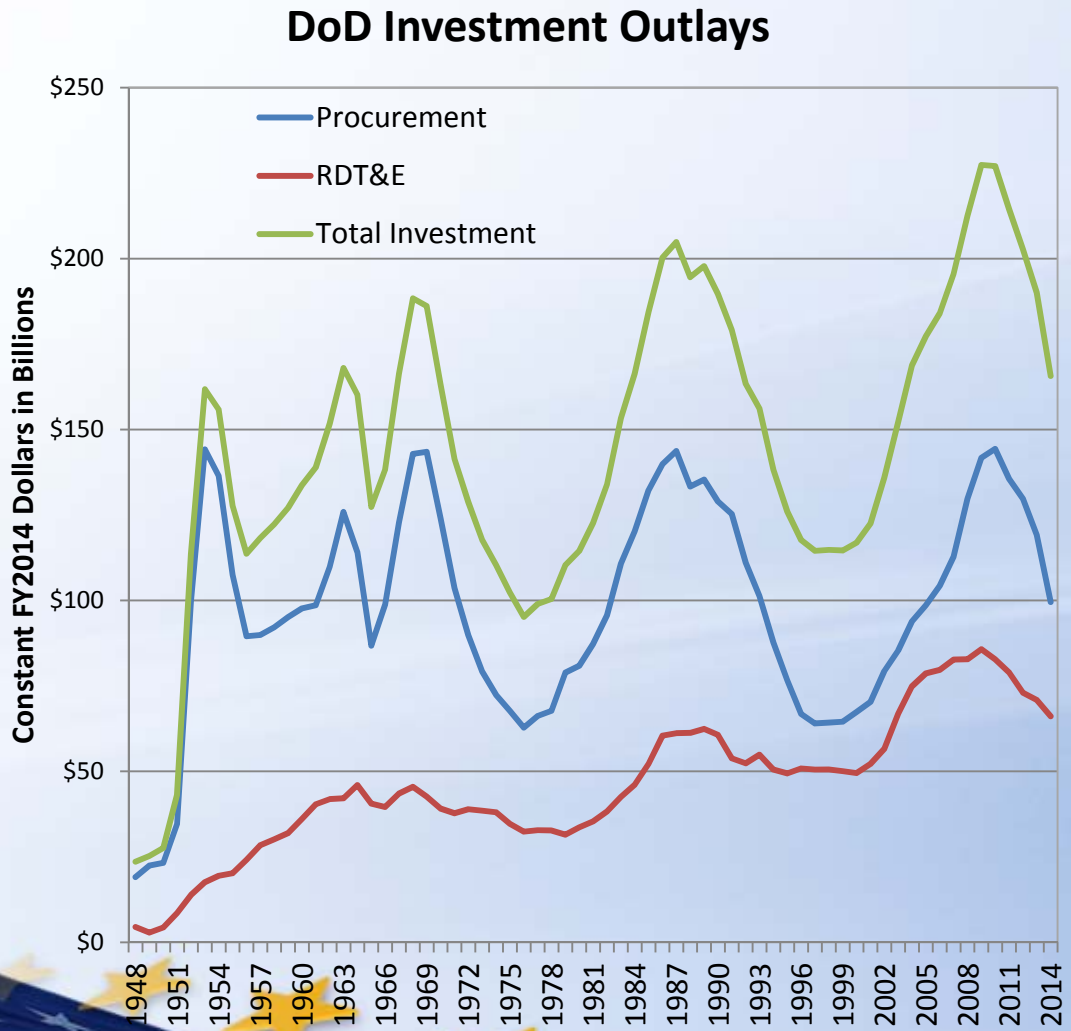
- Scoping the Problem
- Methodology
- Results
- Findings
- Next Steps

Acquisition, Technology and Logistics
Manufacturing and Industrial Base Policy



MIBP Mission: Ensure access to robust, secure and innovative industrial capabilities to fulfill short- and long-term National Security requirements

Budget Swings Have Significant Consequences for the Industrial Base



Contractors & their vendors during

Upswings:

- Acquire resources to address their schedule and performance requirements
- Resources may be limited due to demand

Downswings:

- Decide how much of that capability they can afford to maintain or
- Decide to exit the defense market

Will Warfighter Get Support When Needed?

- **Capitalism: Markets will right-size based on demand**
  - **Companies enter when it is profitable, and exit otherwise**
- **Many capabilities used by defense exist during upswings and downswings**
  - **Capabilities "easy" to reproduce; low barriers to entry**
  - **Market has alternatives or substitutes**
- **But some capabilities are sensitive to defense procurement swings**
  - **Small or no market without defense**
  - **Little slack available during upswings**
  - **Difficult to balance capital investments, specialized labor with large budget changes**

S2T2 Provides Approach for IB Risk Assessment

S2T2 Program Vision

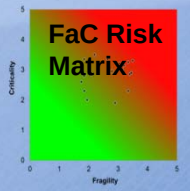
- Develop a collaborative, repeatable, fact-based DoD-wide internal ability to evaluate the impact of acquisition decisions on the industrial base (IB)
  - Monitor and assess
    - industry readiness, competitiveness, ability to innovate, and financial stability
  - Supply analysis to decisionmakers
    - to support investment decisions for preservation and transformation of the IB to support national security objectives

S2T2 Program Objectives

- Integrate IB considerations into acquisition strategy decision making
- Identify successful IB management efforts
- Reduce duplication of effort in OSD and Services
- Establish early warning indicators
- Identify Industrial Base risk, particularly at the lower tiers of the supply chain

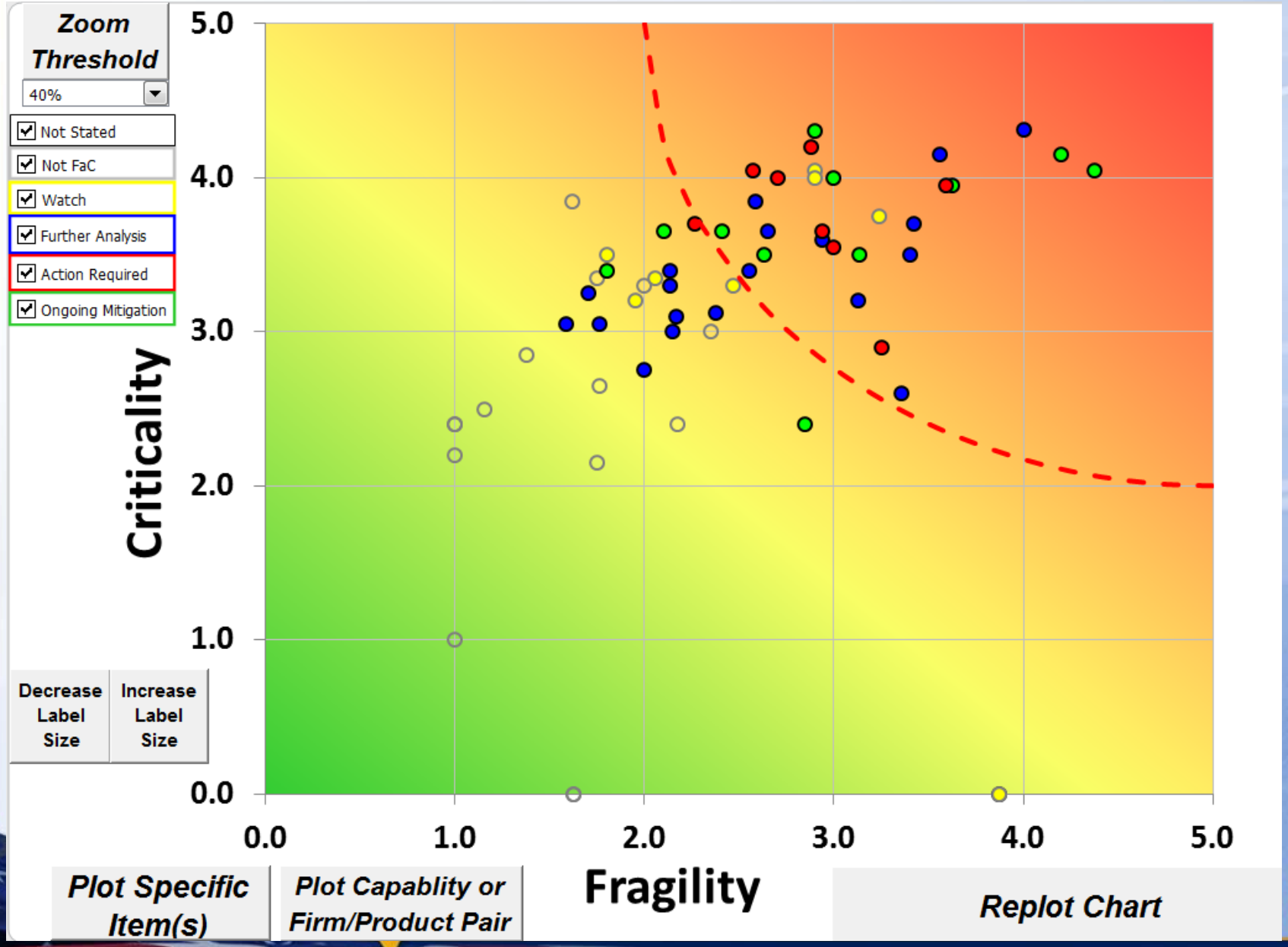
Leverage a statistically-validated & standardized Fragility & Criticality (FaC) assessment process to analyze risk across the tiers of the Industrial Base

S2T2 FaC Process

Process Activity	Action	Outcome
Select Sector/SubSector	Scope the problem (existing risk assessments; program shutdowns)	Preliminary Sector Taxonomy
Search Available Data	Identify IB-related risks & related capabilities/products Identify suppliers and market	Expanded Taxonomy and Product Supplier Pairs
FaC Screening/Filtering	Focused set of IB-related risks for further assessment	Screened IB/Issues Capability-Supplier Pairs
Conduct FaC Matrix Assessment	Facilitated scoring, based on standardized criteria, by SMEs	FaC Risk Matrix 
Validate & Mitigate High Risk Issues; Develop Mitigation Strategy(ies)	SME “deep dive” into IB risk areas; facility visits	High Risk IB Issues

S2T2: iterative, repeatable, collaborative, fact-based

Assessments Provide Guidance for Action



FaC Pilots Provide Insights and Direction

- Key lessons learned
- Test analytic framework
- Refine factor definitions

FaC Pilots: Some Key Lessons Learned

- FaC process well-suited to assessing a portfolio of suppliers supporting similar capabilities, and deriving cross-cutting solutions
  - Program-specific FaC's that repeat IB assessments reveal little new information
- Some criticality factor definitions ambiguous, redundant; Some fragility factors are difficult to obtain
- Insure the taxonomy is standardized
  - Map results to taxonomy

FaC Pilots: Test Analytic Framework (1 of 2)

- **Conclusion: Pilots improved understanding of factor definitions and scoring**
- **Combine FaC-Matrix data from pilot assessments**
  - **Consistent scoring?**
  - **Redundant factors?**
  - **Contribution to criticality/fragility constructs?**
  - **Missing factors?**
- **Empirical tests: Weights**
  - **Different weights employed, but same core set of factors deemed "most important"**
  - **Applying uniform weights to combined data set do not alter the observed outcomes from individual FaC's**

FaC Pilots: Test Analytic Framework (2 of 2)

- **Empirical tests: Redundant factors**
  - Pilots indicated redundant, difficult factors
  - Eliminating sub-set of fragility factors from combined data set do not alter the observed outcomes from individual FaC's
- **Statistical tests: Criticality**
  - Factor analysis: Identified 2 unique *sets* of factors consisting of 5 items: Defense unique, skilled labor, design intensity, reconstitution cost, availability of alternatives
  - Cronbach's Alpha: 5 items reliably measure the same latent construct
  - Combined construct: "niche capabilities," "difficult to replace if lost"
  - Empirical application of sub-set of criticality factors do not alter the observed outcomes from individual FaC's

FaC Pilots: Refine Definitions, Weights

- **Criticality: "critical niche products," "difficult to replace if lost"**
  - **Pilots suggest missing factor: equipment and facility**
  - **Pilots suggest clarification: "Reconstitution" to consider impact on DoD relative to time to restore the capability, if lost**
  - **6 factors consistent with construct, equal weights**
- **Fragility: "risk of exit by current *supplier*, risk current *market* cannot meet requirements"**
  - **Pilots suggest doing deep dive to gain factory-floor perspective when warranted**
  - **4 factors consistent with construct, equal weights: 2 supplier, 2 market**
  - **Improve data collection for supplier information**

S2T2 Fragility and Criticality Criteria: Refined based on FY13 Pilot Assessments

Capability = technology, part, component, product

Criticality:

- **Characteristics that make a specific *Capability* difficult to replace if disrupted**

Defense unique capability
Skilled labor requirements
Defense Design requirements
Facility & Equipment requirements
Reconstitution time
Availability of Alternatives

Fragility:

- **Characteristics that make a specific *Capability* likely to be disrupted**

Financial Outlook (Current provider)
DoD Sales (Current provider)
Firms in Sector (Existing market)
Foreign Dependency (Existing market)

S2T2: collaborative, iterative, repeatable, fact-based

14

Tools for FY14 FaC Assessments

- FaC-List – collect information so that it is more easily shared
- FaC-Matrix – include options to identify and isolate areas of interest
- FaC-Validation – template to document results more consistently
- FaC-Summary – guidelines to communicate findings

Next Steps for FaC Process

- Conduct pilot FaC assessments for skills
- Improve capture and sharing of FaC data
- Data mining to improve fragility ratings

Leadership Awareness

- **Deputies Management Action Group (DMAG) chaired by DEPSECDEF**
  - **Spring 2013 – Include Industrial Base Considerations in POM planning.**
  - **Late 2013 – Resource Decision Memorandum for remedial actions on imminent industrial base risks.**
  - **Late 2014 – Industrial Base DMAG requested by USD (AT&L), to be informed by 2014 assessments.**

2014 Industrial Base Assessment milestone: DEPSECDEF DMAG

BACK-UP CHARTS

Four Principle Types of Decision Points

- **Individual Program Acquisitions**
  - Milestone A
  - Milestone B
  - Milestone C
  - Termination
- **Budget Cycle / Portfolio Reviews**
  - Annual/Bi-annual
  - Secular defense build/shrink
  - Annual Report
- **Long-Term Working Groups**
  - Defense Production Act (DPA) Study Groups
  - Supply Chain Risk Management
  - DIB Information Assurance
  - Critical Infrastructure Program
  - Space Industrial Base Council/Critical Technologies Working Group
  - Joint Industrial Base Working Group (JIBWG)
  - NATIBO
- **Emergent Issues**
  - CFIUS/M&A
  - Individual Company Issues
  - Individual Program Issues
  - External event
  - Surge

Having current & complete analyses of the IB enhances DoD Senior Leader decision-making & allows timely identification of the impacts of program changes!

Assumptions

- DoD will never have complete Industrial Base visibility
  - But, most areas of the industrial base are not critical or fragile.
  - S2T2/FaC approach quickly winnows out non-critical capabilities to focus attention – and resources – on areas of potential risk
- IB Assessment Process
  - Should take maximum advantage of information routinely produced as part of the normal business process
  - Must accommodate flexibility where warranted and uniformity where required
  - Is iterative and seeks to continuously expand DoD's insight into IB capability and constraints.

Product Criticality Ratings - v5: Rev Date 01NOV2013					
Rating	a	b	c	d	e
Technology, part. Criticality = Characteristics that make a specific product or service difficult to replace if disrupted.					
Defense Unique	**Q: To what degree is the market for this capability commercial?**				
	80% or more commercial market	30-60% commercial. Low barriers to enter market	30-60% commercial. Significant and costly barriers to entry	20% or less commercial. Relatively low barriers to entry	20% or less commercial. Significant and costly barriers to enter market
Skilled labor requirement	**Q: To what degree are specialized skills needed and available to integrate, manufacture or maintain this capability?**				
	Minimal special skills. Expertise commonly available or easily obtained.	Specialized skills, but processes well documented. No workforce issues.	Highly specialized skills, no workforce issues near term.	Highly specialized skills, potential workforce issues near term (e.g. limited specialists available)	Highly specialized skills and workforce issues anticipated (e.g. Limited specialists; diminishing workforce)
Defense design requirements	**Q: To what degree is defense-specific knowledge required to reproduce this capability, an alternative, or the next generation design?**				
	Designs are commercially available. Minimal defense-related knowledge required.	Designs are commercially available, but some defense-specific (non-commercial) knowledge required.	Specialized and defense-specific, no workforce issues near term	Specialized and defense specific, potential workforce issues near term (e.g., limited availability)	Highly specialized and limited workforce (e.g., unique defense parameters, security clearance, proprietary practices)
Facility & Equipment requirements	**Q: Are specialized equipment or facilities needed to integrate, manufacture, or maintain this capability?**				
	Minimal. Equipment/facilities are common	Limited. Alternative sources can produce similar products.	Moderate. (e.g., qualification of production line; specialized skills or technology)	Specialized	Highly specialized equipment/facilities are required
Reconstitution Time	**Q: What is the impact on the DoD in time to restore this capability if it is lost?**				
	Minimal time impact to restore	Limited time impact to restore	Moderate time impact to restore	Significant time impact to restore	Severe time impact to restore.
Availability of Alternatives	**Q: To what degree are cost, time, and performance-effective alternatives available to meet DoD needs?**				
	"Drop-ins" exist and are currently used in other programs	Alternatives exist. Low/limited impact to substitute	Moderate impact to incorporate substitute alternatives	Significant impact to use substitute alternatives	Severe impact: Limited or no reasonable alternatives or workarounds exist

Product Fragility Ratings - v5: Rev Date 01Nov2013					
Rating	**a**	**b**	**c**	**d**	**e**
Fragility = indicator of whether the Department will receive what it needs when it needs it from (1) the current provider, (2) the existing market					
Financial Outlook *(current provider)*	**Q: What is the risk of this facility going out of business or exiting the market for this capability?**				
	Very low risk. Viable and stable. (e.g. excellent overall financial rating and strong product line)	Some risk.	Moderate risk. (e.g. financial indicators risk or risk of the facility ceasing capability production are moderate)	Strong risk.	Severe risk. Imminent exit (e.g., firm going out of business or facility leaving the business line)
DOD Sales *(current provider)*	**Q: How much total sales for this facility are from DoD contracts?**				
	Mixed DoD and non-DoD *Market*		Significant but not dominant DoD *or* non-DoD market		Dominance: >80% or <20% in total *DoD* sales
Firms in Sector (existing market)	**Q: How many firms currently participate in this firm's market for this capability?**				
	More than 10	6 to 10	3 to 5	2	1
Foreign Dependency (existing market)	**Q: What is the dependence on foreign sources for this capability?**				
	Domestic suppliers	1 or 2 domestic supplier(s), foreign source(s) may exist	Current foreign source, but domestic supplier(s) exist	Only foreign source(s) exist, potential for domestic source	Only foreign source(s) exist

Statistical Testing Results

- **Criticality Items**
  - **Factor Analysis identified 3 factors (eigenvalue>1)**
    - **Note Factor Analysis "factor" interrelated variables**

Factor Matrix			
	Factor		
	1	2	3
FAC01	.648	-.465	.108
FAC02	-.178	.396	.112
FAC03	.655	-.196	.004
FAC04	.734	.002	.013
FAC05	.497	.514	.411
FAC06	.296	-.077	.144
FAC07	.032	.140	.119
FAC08	.655	.259	-.229
FAC09	.314	.292	-.517

  - **Factor 1: Defense Unique, Skilled Labor, Design Intensity, Reconstitution Cost**
  - **Factor 2: Availability of Alternatives**
  - **Factor 3: Long-lead time (inverse)**